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(54) Process for the Production of Asbestos-free Building Board by the Take-up Method

(57) Asbestos can be successfully replaced by cellulosic fibres in the production of asbestos-free, gypsum-based building board by the take-up method provided that the wet pulp used contains 3 to 30% of the dry weight of cellulosic fibres which have been beaten to a degree of 30 to 70° Shopper Riegler, and 70 to 95% of gypsum as the hemihydrate.

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SPECIFICATION

Process for the Production of Asbestos-free Building Board by the Take-up Method

The present invention relates to the production of an asbestos-free gypsum-based building board by the take-up method.

The use of asbestos fibres is restricted by laws and statutes owing to the health hazard they constitute. Asbestos-free gypsum-based building boards with mineral-fibre reinforcement are known. The boards are usually manufactured by known casting or compressing methods. Attempts have also been made to manufacture such boards by a mechanical take-up method, e.g. using the Hatschek machine. However, so far the results have not been satisfactory. For this reason it has not been possible to initiate industrial mass production of such asbestos-free boards by this method.

One prerequisite for an acceptable gypsum-based building board is that the wet pulp from which the raw board for a building board is manufactured by take-up layers coheres and remains homogeneous throughout the process. The constituents of the wet pulp must not become segregated, for example, in those parts of the machine in which the wet pulp is lifted against gravity. Thus, the wet pulp must contain a constituent which prevents the segregation of the bonding agents and other constituents. This constituent, the so-called carrier fibre, must be structurally adhesive, i.e. it must adhere to other similar fibres in such a manner that a homogeneous web is formed in which the intermediate spaces are filled with the bonding agent and other necessary constituents. At the same time it is desirable that the carrier fibre also has a reinforcing effect in the complete board. In this sense asbestos fibre has been an excellent compromise fibre.

Several attempts have been made to replace asbestos fibres by organic fibres. Their lower density makes it possible to mix heavier and stronger inorganic fibres with the wet pulp in order to compensate for the reduced reinforcing effect. A known fibre combination for the manufacture of asbestos-free building boards by the take-up method is cellulose fibres, possibly in the form of waste paper, as carrier fibers and glass fibres as reinforcement fibres. Fibres of each kind are batched by a known method into the wet pulp, which is taken up continuously by a machine, layer by layer, to form the desired board thickness. Such manufacturing technology is known from, for example, United States Patent No. 3,951,735.

The problem of keeping the wet pump cohesive is very great if the carrier fibre is cellulose fibre. Wet pulp cannot be kept cohesive and homogeneous since this fibre is smooth and cannot be used as such for forming a web structure in the wet pulp. For this reason, according to the said United States Patent, asbestos fibres have been used in addition to cellulose fibres to achieve the necessary carrier properties.

The present invention makes it possible to eliminate asbestos fibres totally, by using only cellulosic fibres as carrier fibres in producing gypsum-based building boards by the take-up method. The process of the present invention comprises forming a wet pulp comprising, as carrier fibres, cellulosic fibres which have been beaten to a degree of 30—70° Shopper-Riegler in a proportion of 3 to 30% of the total dry weight of the pulp, gypsum as the semi-hydrate in a proportion of 70 to 95% of the total dry weight of the pulp, an agent for decelerating the bonding of the gypsum in a proportion of 0.1 to 2% of the dry weight of the pulp, a small amount of a flocculant, and reinforcement fibres, filler fibres and/or weight additives in an amount to make up the balance to 100% of the dry weight of the pulp in respective proportions 0 to 10% of reinforcement fibres, 0 to 25% of filler fibres, and 0 to 25% of weight additives, and then forming the said board from the said pulp by the take-up method.

Experiments have shown that the cellulosic fibres, which may be deciduous and/or coniferous wood pulp fibres and/or waste paper fibres, can produce as good carrier properties in the wet pulp as asbestos fibre provided that the cellulosic fibres, before being batched into the wet pulp, are ground in a cone mill or other known comminuter to a degree of 30—70°SR (Shopper-Riegler). After this treatment the adhering property of the fibres is at least as good as that of asbestos fibres. The carrier property of the fibres can be totally regulated by this measured quantity. The treated cellulosic fibres may be batched into, and mixed with, the wet pulp by a known method.

The use of heavier and stronger inorganic fibres, especially glass fibres, as reinforcement fibres is possible in the invention to a higher degree than that used so far. Reinforcement fibres can be added in quantities up to 10% of the total weight of the dry material of the pulp. In addition, filler fibres, weight additives and flocculating agents, agents which decelerate the bonding of gypsum, and the amount of water required by the dry materials are used for forming the wet pulp. The proportions used have already been given. In the case of the flocculant an amount of about 200 ppm is usually appropriate.

Thus an entirely asbestos-free, fibre-reinforced raw board is obtained which has the same good strength properties, and in many cases better strength properties than gypsum-based raw boards made by the same mechanical process and using otherwise the same constituents but using asbestos fibres as the carrier fibres.

The following are Examples of building boards which may be produced in accordance with the invention. In each case the stated ingredients were mixed and made into a board by the take-up method, and the board obtained had the stated properties.

Example 1

	Percent
Cellulosic fibres (preferably coniferous wood pulp fibres) ground to a degree of 50°SR	10
Calcined gypsum	80
Mineral additives plus agent for decelerating the bonding of gypsum	10

After hardening and drying, the board obtained had the following properties:

Density	1237 Kg/m³
Bending strength	15.2 N/mm²
E-modulus	2853 N/mm²

Example 2

	Percent
Cellulosic fibres ground to a degree of 50°SR	10
Calcined gypsum	68
Mineral additives plus agents for decelerating the bonding of gypsum	22

The properties of the board obtained were:—

Density	1228 Kg/m³
Bending strength	18.6 N/mm²
E-modulus	3205 N/mm²

Example 3

	Percent
Cellulosic fibres ground to a degree of 50°SR	10
Calcined gypsum	62
Mineral additives plus agent for decelerating the bonding of gypsum	28

The properties of the board obtained were:—

Density	1309 Kg/m³
Bending strength	19.7 N/mm²
E-modulus	3610 N/mm²

Claims

1. A process for the production of an asbestos-free building board which comprises forming a wet pulp comprising, as carrier fibres, cellulosic fibres which have been beaten to a degree of 30—70° Shoppar-Riegler in a proportion of 3 to 30% of the total dry weight of the pulp, gypsum as the semi-hydrate in a proportion of 70 to 95% of the total dry weight of the pulp, an agent for decelerating the bonding of the gypsum in a proportion of 0.1 to 2% of the dry weight of the pulp, a small amount of a flocculant, and reinforcement fibres, filler fibres and/or weight additives in an amount to make up the balance to 100% of the dry weight of the pulp in respective proportions of 0 to 10% of reinforcement fibres, 0 to 25% of filler fibres, and 0 to 25% of weight additives, and then forming the said board from the said pulp by the take-up method.

2. A process according to Claim 1 in which the cellulosic fibres are deciduous and/or coniferous wood pulp fibres and/or waste paper fibres.

3. A process according to Claim 1 or 2 in which the pulp contains one or more of glass fibres, mineral wood fibres, sisal fibres, rayon fibres, lime, limestone powder, and diatomite.

4. A process according to Claim 1 substantially as hereinbefore described.

5. Asbestos-free building board when produced by the process of any of the preceding claims.

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